Aunt Cathy's Guide to Nutrition:

Amino Acids and Protein

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Structure

Structure of an amino acid: R
N-C-COOH

N = Nitrogen (NH3 & 4) ammonia C = Carbon
COOH = acid end, made out of carbon, hydrogen and oxygen ("carboxyl group" – "boxcar")
Metabolic by-products = energy, CO2, water & N

Structure of Proteins = chains of AAs held together by peptide bonds
Short chains (e.g. 2-6 AAs)= peptides Long chain = protein. Most proteins are over 50 AAs long.
All proteins contain all 20 AAs., but collagen is odd.

Primary Structure **Number** of each AA present in the mix

Secondary Structure **Order** of the AAs strung together on a chain. Example of a problem when one AA is in the wrong place on the chain: **Sickle cell anemia**.

Tertiary Structure **Shape** of the molecule due to certain AAs attracting or repelling each other. **Sickle cell anemia**: the problem at the Secondary level causes problem at this level: the shape of the red blood cell is not round but is sickle-shaped and easy to break. Shape is also important in **allergy** – the immune system recognizes proteins by their shape and reacts to it.

Quaternary Structure Some proteins contain **more than one protein chain**. Examples: **Insulin and Hemoglobin.**

Things made out of protein

Muscles and other body tissues,
Some hormones (like insulin and glucagon)
Albumin (a carrier protein +oncotic pressure)
Hemoglobin (a carrier made of 4 protein chains with iron in the center: carries O2 to tissues)
Ferritin (an iron-storage protein)
Transferrin (a carrier protein for iron
Enzymes,
Immune Antibodies,
Collagen (connective tissue)
Markers of protein status: Albumin, Transferrin, Pre-albumin, C-Reactive Protein in blood
"Buffering" activity to maintain appropriate body pH (alkalinity and acid)

Things made out of Amino Acids and Peptides

Neurotransmitters (e.g Dopamine, Norepinephrine, Serotonin, Melatonin)
Example of a problem: Inadequate production of dopamine results in parkinsonism
Example of a problem: PKU (Phenylketonuria) – can't get rid of excess phenylalanine, an essential amino acid. Without a very special diet, mental retardation develops. With careful diet: normal development.

Vegetarianism issues

Complementary proteins
"Limiting Amino Acid"
Omnivore
Macrobiotic Diet
Vegan
Lacto-vegetarian

Lacto-ovo-vegetarian
Grains --- Lysine is limiting AA
Legumes (beans)—Methionine is limiting AA
Essential AAs
Non-Essential AAs
Conditionally Essential AAs
Amino Acid Pool -- Do we have protein stores?

HBV- High Biologic Value (amino acid content well-suited to make human tissue): best = egg; meat and milk next best.
LBV – Low Biologic Value (amino acid content not as well-suited to make human tissue; need more quantity to make up for poor quality, and more AA waste produced): plant proteins
Protein Score PDCAAS

Using protein and Amino Acids for energy

Is protein the body's preferred source of energy?
How about in athletes?
Excretion of N waste product
Urea / BUN
Liver & kidney role in N excretion
Hyperammonemia
"Draw a star" test
Delirium Tremens
Hepatitis / Fatty liver
Cirrhosis of the liver
Alcoholism
Regeneration potential of the liver
Effect on kidneys of chronic high protein intake
Increased water requirements with high N waste.
"Atkins" /Ketogenic-type diets for healthy adults
Ketogenic diets for seizure control.
"Carbon skeleton"
"Protein Sparing"
Renal Solute Load
4 kcal/g

Protein /Calorie Malnutrition (PCM)

Kwashiorkor – Second Child Disease
Aflatoxin mold on Peanuts
Flaky Paint, Flag Sign
Marasmus
Dysentery
Edema

If protein ok but calories are inadequate, the protein will be burned for energy instead of using it for growth or body repair … because the body's first need is for energy!

Nitrogen Balance (N in = N out)
Gluconeogenesis
Homeostasis (Maintaining all systems within the normal ranges.)
Anabolism (Take in more N than you excrete in urine: growth, pregnancy, muscle building,etc.)
A = Add + metabolism
Catabolism (Excrete more N in urine than you take in: trauma, inadequate kcals, illness,etc.)
C= Catastrophe + metabolism
Protein requirements: World Health Organization (WHO) : Adults need 0.8 g protein per kg body weight
Practical interpretation: 1 g/kg (1 kg = 2.2 lbs) Babies need twice as much, pound for pound (about 2 g/kg) because of growth. They double their birthweight by 6 mo, and triple it by 1 year. What would happen if you doubled your present weight by 6 months from now? [Note: The WHO recommended minimal levels of protein are about to be increased because it appears that this intake level is not adequate.
If protein is consumed in amounts above a person's requirement, it will be converted to glucose and/or fat.

Allergy issues:

Immunoglobulin E
Hypoallergenic
Protein shape
Anaphylaxis
"Gut permeability"
Gluten-sensitive enteropathy
(Celiac Disease)
GI villi damaged from wheat, rye barley + other effects

Digesting protein

"Denatured" –acid, heat, enzyme action, manipulating, etc.
Why can't a person take insulin orally?
Immune system
Pancreatic Proteases and Peptidases, absorption in the small intestine. Absorption onto the portal circulation (blood heading toward the liver)
"Curds and Whey"